

REMARKS

The Office Action dated April 3, 2006, has been received and reviewed.

Claims 1-28 are currently pending and under consideration in the above-referenced application, each standing rejected.

Reconsideration of the above-referenced application is respectfully requested.

Rejections Under 35 U.S.C. § 103(a)

The standard for establishing and maintaining a rejection under 35 U.S.C. § 103(a) is set forth in M.P.E.P. § 706.02(j), which provides:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Chen

Claims 1, 8-10, 12-14, 18-20, 23, and 25-28 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in U.S. Patent 6,020,259 to Chen et al. (hereinafter "Chen").

Independent claim 1 is directed to a method that includes selective deposition of metal silicide and the subsequent, in situ, deposition of an interconnect material.

The method of independent claim 20 includes selective deposition of a contact material and the subsequent, in situ, deposition of an interconnect material.

Chen teaches a process that includes selectively depositing titanium silicide on a surface of a silicon substrate that is exposed through a contact opening, then blanket depositing titanium

nitride over the interconnect. Chen does not include any teaching or suggestion that these deposition processes may be effected *in situ*.

It has been asserted that Chen's use of the term "subsequent" in describing the order of titanium silicide and titanium nitride deposition processes and the fact that Chen teaches that both processes may be effected by chemical vapor deposition (CVD) implies and inherently teaches that the processes are conducted in the same chamber, or *in situ* with one another. Final Office Action, pages 2 & 3. Notably, a teaching is inherent only if it is necessary. M.P.E.P. § 2112. In fact, the term "subsequent" in Chen does not imply anything other than the fact that the titanium silicide deposition process is followed by the titanium nitride deposition process. Without actually teaching or suggesting that the two processes of Chen are effected in the same chamber, or *in situ*, one cannot imply anything more from the disclosure of Chen. This is particularly true since one of ordinary skill in the art would readily understand that the titanium silicide deposition process disclosed in Chen could be effected in a different chamber from the titanium nitride deposition process disclosed in Chen.

In view of the foregoing, it is respectfully submitted that there are at least two reasons that the teachings of Chen do not support a *prima facie* case of obviousness against any of claims 1, 8-10, 12-14, 18-20, 23, or 25-28.

First, it is respectfully submitted that, without the benefit of hindsight that the claims of the above-referenced application afford the Examiner, one of ordinary skill in the art wouldn't have been motivated to modify teachings from Chen in the manner that has been asserted. It has been asserted that, since Chen teaches a process in which a metal silicide and an interconnect material may be deposited and that both of these materials may be deposited by the same process (*i.e.*, chemical vapor deposition (CVD)), that it would have been obvious to one of ordinary skill in the art to effect these deposition process *in situ* with one another. If it would have been obvious to conduct deposition processes that require at least one different reactant *in situ* with one another, then there surely would have been some disclosure to that effect in the prior art. Unfortunately, there is none.

Notably, the teachings of Chen are limited to introducing single sets of reactants into a chamber while a semiconductor substrate resides therein. More specifically, in Chen, a first set

of reactants, which are necessary for depositing titanium silicide, are introduced into a chamber with a substrate therein. Col. 3, lines 2-19. Without teaching or suggesting that the semiconductor substrate may remain in the chamber in which the titanium silicide deposition occurred, Chen teaches that titanium nitride is deposited onto the semiconductor substrate as another, second set of reactants chemically react with each other.

Therefore, Chen includes no teaching or suggestion that could have motivated one of ordinary skill in the art to modify its teachings in such a way as to effect to different deposition processes *in situ* with one another.

Second, Chen does not teach or suggest each and every element of any of claims 1, 8-10, 12-14, 18-20, 23, or 25-28.

Chen lacks any teaching or suggestion of “depositing an interconnect material onto . . . metal silicide after and in situ with causing [a] chemical reaction” “to selectively deposit metal silicide” on the “surface of at least one exposed, doped area of [a] semiconductor device structure,” as required by independent claim 1. Nor does Chen teach or suggest “depositing an interconnect material onto [a] contact material after and in situ with causing [a] chemical reaction” “to selectively deposit [the] contact material” on an “exposed active device region of [a] semiconductor device structure,” as required by independent claim 20.

In this regard, Chen merely teaches that “a blanket chemical vapor deposition is carried out . . . to form a TiN layer” subsequent to the selective deposition of a TiSi₂ layer. Col. 3, lines 20-23.

Therefore, it is respectfully submitted that, under 35 U.S.C. § 103(a), independent claims 1 and 20 recite subject matter which is allowable over the teachings of Chen.

Claims 8-10, 12-14, 18, and 19 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Each of claims 23 and 25-28 is allowable, among other reasons, for depending directly or indirectly from claim 20, which is allowable.

Chen in View of Chang

Claims 2-5 and 21-22 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in Chen as applied to claims 1, 8-10, 12-14, 18-20, 23, and 25-28 above, and further in view of teachings from U.S. Patent 5,043,299 to Chang et al. (hereinafter “Chang”).

Claims 2-5 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Claims 21 and 22 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 20, which is allowable.

Claim 22 is further allowable since neither Chen nor Chang, taken together or separately, teaches or suggests exposing a semiconductor device structure to a nitrogen-ammonia plasma. While the Office has asserted, at page 5 of the Final Office Action, that use of a nitrogen-ammonia plasma would be obvious depending upon the type of material to be cleaned, the Office has not shown any art that discloses use of such a plasma.

Chen in View of Kolar

Claims 6 and 7 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is purportedly unpatentable over the teachings of Chen, in view of teachings from U.S. Patent 5,162,259 to Kolar et al.

Claims 6 and 7 are both allowable, among other reasons, for depending directly and indirectly, respectively, from claim 1, which is allowable.

Chen in View of Kim

Claims 11 and 24 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in Chen et al., in view of teachings from U.S. Patent 5,821,164 to Kim et al. (hereinafter “Kim”).

Claim 11 is allowable, among other reasons, for depending directly from claim 1, which is allowable.

Claim 24 is allowable, among other reasons, for depending directly from claim 20, which is allowable.

Furthermore, a *prima facie* case of obviousness has not been established against either claim 11 or claim 24. Kim has been relied upon for purportedly teaching that an interconnect material may be selectively deposited. Kim even asserts that a conductive layer 16, which may be formed from a material such as aluminum, copper, titanium, or titanium nitride, may be “selectively deposited on the exposed surface of [an] interlevel layer 14a[,] including [a] contact hole 15[therethrough].” Col. 4, lines 24-27. From FIG. 2f of Kim, however, it appears that the interlevel layer 14a covers the entire substrate 11, and that the entire upper surface of interlevel layer 14 appears to be exposed. Moreover, the formation of conductive layer 16 must be followed by an etch-back, as explained at col. 4, lines 28-31 of Kim, to remove conductive material from the upper surface of the interlevel layer 14a and, thus, to define conductive lines 16 within the contact holes 15. Thus, deposition of the conductive layer 16 would certainly not be selective.

Chen also lacks any teaching or suggestion of selectively depositing an interconnect material.

As claims 11 and 24 both require that an interconnect material be selectively deposited, according to the ordinary meaning of that term, as used in the art, the teachings of Kim cannot be combined with teachings from Chen in such a way as to establish a *prima facie* case of obviousness against either of these claims.

Chen in View of Shinriki

Claims 15-17 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is allegedly unpatentable over the subject matter taught in Chen, in view of teachings from U.S. Patent 6,001,729 to Shinriki et al.

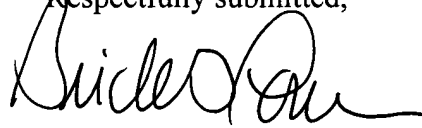
Claims 15-17 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

It is respectfully requested that the 35 U.S.C. § 103(a) rejections of claims 1-28 be withdrawn.

CONCLUSION

It is respectfully submitted that each of claims 1-28. is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Brick G. Power", written over a horizontal line.

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